

## A 1.2 THz planar tripler using GaAs membrane based chips

**J. Bruston\***, A. Maestrini, D. Pukala, S. Martin, B. Nakamura and I. Mehdi

\*ESA – ESTEC, Noordwijk, NL

Caltech, Jet Propulsion Laboratory, 4800 Oak Grove dr., Pasadena, CA 91109

### ABSTRACT

Fabrication technology for Submillimeter-wave monolithic circuits has made tremendous progress in recent years and it is now possible to fabricate sub-micron GaAs Schottky devices on a number of substrate types, such as membranes [1], frame-less membranes [2] or substrateless circuits [3]. These new technologies allow designers to implement very high frequency circuits, either Schottky mixers or multipliers, in a radically new manner.

This paper will address the design, fabrication, and preliminary results of a 1.2 THz Schottky tripler fabricated on a GaAs frame-less membrane [2]. This tripler uses a diode pair in an antiparallel configuration similar to designs used at lower frequencies [4]. This configuration has the distinct advantage that only odd harmonics are generated. The availability of the membrane allows one to move the diodes away from the waveguides, to which they are coupled by means of stripline matching circuits and waveguide probes, providing a relatively tolerant circuit. To date, measurement with a fully solid state source has produced a peak output power of 12  $\mu$ W at 1130 GHz at 300K, and a record 75  $\mu$ W when cooled to 35K. The design of the conceptually simple circuit, together with its fabrication procedure and preliminary results will be presented.

- [1] P.H. Siegel, R.P. Smith, S. Martin and M. Gaidis, "2.5 THz GaAs Monolithic Membrane-Diode Mixer", *IEEE Transactions Microwave Theory and Techniques*, vol. 47, no. 5, pp. 596-604, May 1999.
- [2] J. Bruston, S. Martin, A. Maestrini, E. Schlecht, R.P. Smith, I. Mehdi, "The Frame-less Membrane: A Novel Technology for THz Circuits," *Proc. Eleventh International Symposium on Space THz Technology*, Ann Arbor, May 2000.
- [3] E Schlecht, J. Bruston, A. Maestrini, S. Martin, D. Pukala, R. Tsang, A. Fung, R. P. Smith, I. Mehdi, "200 And 400 GHz Schottky Diode Multipliers Fabricated with Integrated Air-Dielectric "Substrateless" circuitry," *Proc. Eleventh International Symposium on Space THz Technology*, Ann Arbor, May 2000.
- [4] C.P. Hu, "Millimeter wave frequency multipliers employing semiconductor diodes in a balanced configuration," *Proc. 16th European Microwave Conf., Dublin 1986*, 247-251.